

-- 81. The method of preparing the electrically conductive polymer blend defined in claim 70 which is formed by the thermal imidization of polyamic acid and polyaniline. --

REMARKS

Claim 53 has been modified to be more specific and to distinguish the present application from the prior art. As now amended, it encompasses the resulting reaction product of a Lewis base, electrically conducting polymer in undoped form, and a Lewis acid polymer dopant in an organic solvent to form a conducting blend in solution, said blend remaining soluble in said organic solvent. The product does not precipitate out of solution as in the prior art.

The Examiner asserts that "Applicants claim an electrically conductive composition . . ." This assertion does not cover the claimed composition but rather serves only to functionally define the property of the blend, i.e., electrically conducting. As noted above, applicants in fact claim a polymer blend comprising the reaction product of a polyacid and a conducting polymer in undoped form. The 2 polymers are reacted in solution via an acid/base reaction and said blend or reaction product remains soluble in organic solvents, and the two polymers are miscible. Because of its solubility, the resulting blend can be further processed by solution casting techniques. As a result of the solubility of the resulting blend and chemical interactions between the two polymers, gels can be formed. None of the prior art describes soluble

conducting blends of a polymeric dopant and a conducting polymer as defined in the claims in the instant application.

The polymer blend in the present invention is defined in claim 53 is "a Lewis base electrically conductive polymer in undoped form and a Lewis acid polymer dopant, the resulting conductive blend being soluble in said organic solvent." As now positively recited in Claim 53, these two aforementioned polymers are soluble in a common solvent and react homogeneously in a solution. Because in solution there is a Lewis acid/Lewis base interaction, the two polymers form a compatible blend so that no phase separation occurs. The benefits accruing from the polymers soluble in solution are that the polymers remain in solution, they do not precipitate out of solution and accordingly they can be solution processed.

Claim 53 also provides that the resulting reaction product blend is miscible at the molecular level. Prior art cited by the Examiner mentions polymers which are only similar to those disclosed in the present invention.

In the instant invention the doping can be reversed, as, for example, in the case of polyamic acid which can be thermally cured to polyimide resulting in a compatible polyaniline/polyimide blend.

It is respectfully submitted that the Examiner is ignoring the significance of the reacted polymers remaining in solution and the other features disclosed above.

It is well known in the polymer art that for thermodynamic reasons, polymer pairs in general are not miscible on molecular

level. Further the degree of compatibility of two polymers generally varies to a high extent. The dispersed phase in uncompatibilized immiscible polymer blends often tends to coalesce during the post compounding processing steps. This is a major problem when dealing with polymer blends. Accordingly the prior art teaches that in order to stabilize and to improve the dispersion of the minor phase, interfacial agents are generally added. These substances, often called "compatibilizers," are required to increase the miscibility of two polymers. As a separate component added to the polymer blend, compatibilizing agents generally possess one part of the molecule which shows affinity towards polar materials while possessing another part which is compatible with non-polar materials, forming links with both phases. The compatibilizers are believed to migrate preferentially towards the interface and reduce the interfacial tension between the components of the blend. The overall effect of compatibilization is a finer and more stable dispersion.

In the present invention there is no need for the addition of a separate third component to the blend.

The present invention achieves a compatible blend by virtue of the reaction product formed in-situ. In the "frustrated blend" as defined in claim 66, the structure of the polymer blend is diametrically opposed to the blends described in the prior art because the frustrated blend freezes or locks the polymers that would otherwise phase separate into a homogeneous non-equilibrium state or condition as a result of kinetic limitations or physical

restrictions. This phenomenon is not directly disclosed nor implied in any of the prior art references cited.

The Examiner is respectfully requested again to reconsider the rejection of claims 53-79 under 35 U.S.C. §103 as being unpatentable over each of U.S. Patents 4,933,106 to Sakai et al.; 4,940,517 to Wei et al.; 5,068,060 to Jen et al. or 4,771,111 to Tieke et al.

U.S. Patent 4,933,106 to Sakai et al. does not teach nor describe the reaction product of 2 polymers. Sakai teaches the electrochemical polymerization of a monomer in an electrolyte such as a polyacid. The monomer is in-situ polymerized. During the electrochemical polymerization, the polymer is also electrochemically doped. The polymer is doped by the application of a voltage which causes oxidation of the polymer backbone resulting in radical cations. The polyacid is simply incorporated as the counteranion of the conducting polymer. There is no reaction product between the conducting polymer and the polyacid described. The monomer grows in the electrolyte and complexes the polyacid as it grows. Once polymerized, the polymer/polyacid blend of this patent is not soluble. It forms a film on an electrode or an insoluble powder. It cannot form a gel. At no point does Sakai et al. teach reacting polymer 1 with polymer 2, nor does it teach a resulting product or blend which is soluble in organic solvent.

By modifying claim 53, applicants have now excluded insoluble powder blends.

The arguments presented above for the Sakai case are hereby

incorporated by reference and applied as appropriate to U.S Patent 4,940,317 to Wei et al.

Wei et al. describe the electrochemical polymerization of aniline monomer in a polyacid electrolyte. The polyacid is incorporated as the counteranion/dopant as the monomer grows. Wei et al. also disclose the chemical polymerization of aniline in a polyacid. The polyaniline/polyacid product precipitates from solution forming an insoluble powder. Again at no point does Wei et al. react polymer 1 with 2 in a solvent and result in a conducting blend which is soluble. The blends of Wei et al. are insoluble powders in the case of the chemical polymerization, and are films in the case of electrochemical polymerization.

A gel is not an obvious modification based upon Sakai et al. and Wei et al., since in the present invention it stems from the interaction of the Lewis acid polymer and the Lewis base polymer and the fact that the polymer blend is soluble. A gel is not possible based upon the teachings of Wei et al. since the polymer blend in Wei et al. is a powder. Likewise, a gel is not possible in Sakai et al. since the doping is done electrochemically and the resultant product is a film. In neither Sakai et al. nor Wei et al. does one have a solution of a conducting blend of polymers that can form a gel.

U.S. Patent 5,068,060 to Jen relates to solutions of poly(heterocyclic vinylenes) with oxidizing/reducing monomeric agents as the dopants. This patent does not disclose the interaction between Lewis acid and Lewis base blends which is

described and claimed in present application; but rather, it discloses redox reactions. In the case of the polyacids, they are again used as electrolytes. The reaction is done electrochemically and insoluble blends result. The arguments set forth above to Sakai et al. and Wei et al. are also hereby incorporated by reference and applied in response to the Jen et al. reference.

U.S. Patent 4,771,111 to Tieke et al. discloses a polyimide coated on a conducting surface; the polyimide is then used as an electrode on whose surface the pyrrole monomer is electrochemically polymerized/deposited. The deposited polypyrrole is doped by external dopants.

In Tieke et al., there is no chemical interaction between the polyamide precursor (polyamic acid) and the polypyrrole. In Tieke et al. there is simply a composite in which there is a layer of polyimide followed by a layer of polypyrrole. In the present invention, the polyamic acid (polyimide precursor) is reacted with the conducting polymer in undoped form resulting in a conducting, soluble, miscible blend. Upon thermal treatment, the polyamic acid is converted to the imide.

Because of the acid/base chemical interactions between the 2 polymers, the polymers in the imidized form remain miscible and homogeneously dispersed. It is only because of the chemical interactions between the two polymers that the miscibility is retained. The miscibility was shown by the X-ray data in the text of the instant application.

In Tieke et al. there are no chemical interactions between the polyimide and the polypyrrole and no miscible blend can be attained.

Tieke et al. is not a blend at all but rather a composite of 1 polymer on top of another.

The number of blends disclosed in each of the references cited by the Examiner is very large. The Examiner of the Office Action provides no motivation why one of ordinary skill in the art would select the specific compounds disclaimed in applicants' invention that would result in one arriving at the presently claimed invention. The mere presence of polymers in a blend is not sufficient to render the present invention obvious. The solubility and other factors noted above distinguish the present invention from the blends allegedly disclosed in the prior art.

A review of the pertinent applicable law relating to 35 U.S.C. § 103 is warranted. It appears that in rejection of the claims in the instant application, the Examiner has applied the references using selective combinations to render obvious the invention.

The Federal Circuit has set guidelines to govern such application of references. These guidelines are found, among other cases, in Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143, 227 USPQ, 543, 551 according to the following principle:

When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than hindsight gleaned from the invention itself.

A representative case relying upon this principle is Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 5 USPQ 2d 1434 (Fed.

Cir. 1988). The district court in Uniroyal found that a combination of various features from a plurality of prior art references suggested the claimed invention of the patent in suit. The Federal Circuit in its decision found that the district court did not show, however, that there was any teaching or suggestion in any of the references, or in the prior art as a whole, that would lead one with ordinary skill in the art to make the combination. The Federal Circuit opined:

Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. [837 F.2d at 1051, 5 USPQ 2d at 1438, citing Lindemann, 730 F.2d 1452, 221 USPQ 481, 488 (Fed. Cir. 1984).]

A fact pattern similarity exists in the application of references by the court in Uniroyal and by the Examiner in this case to find "obviousness."

The Uniroyal case concerned Rudkin-Wiley's patent on an air-deflecting device for reducing wind resistance encountered by tractor-trailer combination vehicles. In holding the subject matter of the claims at issue obvious, the district court had combined teachings from references that relied on different wind resistance principles ("shielding/deflection" and "streamlining"). The Federal Circuit found that these antithetical principles of operation and the absence of any teaching or suggestion to combine the references demonstrated that there was no basis for the district court's obviousness conclusion. 837 F.2d at 1051, citing In Re Sernaker, 702 F.2d 989, 994, 217 USPQ 1,5 (Fed. Cir. 1983). So too in the instant case, the compounds disclosed in the

references are antithetical.

Applicants respectfully submit that there is no basis for the combination of references that the Examiner has cited. Applicants have pointed out how the references teach in different directions. The Examiner has selected elements from the two references for the sake of showing the individual blends that form an "electrically conductive composition," without regard to the total teaching of the Sakai et al., Wei et al., Jen et al. and Tieke et al. references. Essentially, the Examiner is improperly picking and choosing. It is a piecemeal construction of the invention. Such piecemeal reconstruction of the prior art patents in light of the instant disclosure is contrary to the requirements of 35 U.S.C. § 103.

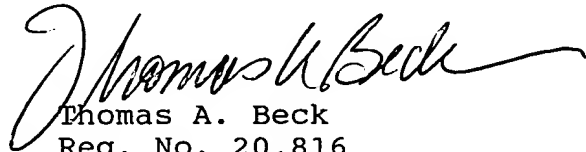
The ever present question in cases within the ambit of 35 U.S.C. § 103 is whether the subject matter as a whole would have been obvious to one of ordinary skill in the art following the teachings of the prior art at the time the invention was made. It is impermissible within the framework of Section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. (Emphasis in original) In re Wesslau 147 U.S.P.Q. 391, 393 (CCPA 1965)

This holding succinctly summarizes the Examiner's application of references in this case because he is in fact picking and choosing so much of the aforementioned references to support his position and does not cover completely in the Office Action the full scope of what the references fairly suggest to one skilled in the art. The solubility in organic solvent, the non-precipitate formation, the miscibility of polymers all recited in the claims,

distinguishes the claims of the present invention from the references.

As a result of the amendments of claims and the arguments presented herein, Applicants respectfully request allowance of claims 53-81.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Thomas A. Beck", written in dark ink.

Thomas A. Beck
Reg. No. 20,816
Rosen, Dainow & Jacobs
489 Fifth Avenue
New York, New York 10017
(212) 692-7000

Date: July 6, 1993

TAB/jf